"IMPROVED STAIN-RESISTANT POLYAMIDE COMPOSITION AND FIBERS AND METHOD OF PRODUCTION THEREOF"

I CLAIM:

A method of forming an acid dye stain-resistant 1 1. fiber or fibers comprising combining a masterbatch concentrate with a fiber-forming polyamide and a polymer and forming a 3 fiber or fibers therefrom, said masterbatch concentrate com-4 prising a reagent and a carrier therefor wherein said reagent 5 has the formula: 6 7 Q and Z are moieties which associate with free acid wherein: 8 dye sites in said polyamide; 9 10 a is an integer from 0 to 2; b is an integer from 1 to 4; and 11 R is selected from the group consisting of ali-12 13 phatic, aromatic or alicyclic hydrocarbyl groups; 14 and said carrier is selected from the group consisting of: 15 a terpolymer comprising from about 56% to about 16 94.5% by weight of at least one alpha-monoolefin having 2 to 17 18 8 carbon atoms, about 5% to about 40% by weight of an

19	ethylene- α , β unsaturated carboxylic acid (1) C_1 - C_4 alkyl or
20	(2) glycidyl ester and from about 0.5% to about 4.0% by weight
21	of an internal anhydride of an ethylenically unsaturated
22	carboxylic acid:

semi-crystalline thermoplastic polyester 23 (B) а having a melting point of about 235°C or less; 24

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- a semi-crystalline thermoplastic polyamide with a melting point of about 235°C or less; and
- mixtures thereof; (D) 27 and further wherein said polymer is selected from the group 28 consisting of (A) and mixtures of (A) with at least one of (B) 29 and (C) wherein the percentage by weight in said polymer of 30 internal anhydride of an ethylenically unsaturated carboxylic 31 acid is in the range of from about 0.5% to about 4.0%.
 - The method of claim 1 comprising melt-spinning 2. 1 said combination of masterbatch concentrate, fiber-forming 2 polyamide and polymer. 3
 - The method of claim 2 comprising combining said 1 masterbatch concentrate, said fiber-forming polyamide and said 2 polymer on-line in said melt-spinning process. 3

- 4. The method of claim 1 wherein said masterbatch concentrate comprises from about 20% to about 80% by weight of said reagent.
- 5. The method of claim 1 wherein said combination contains an amount of said masterbatch concentrate that contains between about 1,500 ppm and about 3,000 ppm of sulfur; an amount of said polymer such that the combination contains between about 0.01% to about 0.6% of the internal anhydride; and the remainder is said polyamide.
- 1 6. The method of claim 5 wherein at least one of 2 said Q and Z is a carboxylic acid group or a salt thereof.
- 7. The method of claim 5 wherein at least one of said Q and Z is an isocyanate group.
- 1 8. The method of claim 5 wherein at least two of said Q and Z combine to form a carboxylic acid anhydride.
 - 9. The method of claim 5 wherein said reagent is 5-sulfoisophthalic acid or a salt thereof.

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- 1 10. The method of claim 9 wherein said reagent is 2 an alkali metal, alkaline earth metal or transition metal salt 3 of 5-sulfoisophthalic acid.
- 1 11. The method of claim 10 wherein said reagent is 2 the lithium salt of 5-sulfoisophthalic acid.
- 1 12. The method of claim 10 wherein said reagent is the sodium salt of 5-sulfoisophthalic acid.
- 1 13. The method of claim 10 wherein said reagent is 3-sulfobenzoic acid or the sodium or lithium salt thereof.
- 1 14. The method of claim 1 wherein, in (A), said 2 alpha-monoolefin is ethylene.
- 15. The method of claim 1 wherein, in (A), said
 2 ethylene-α,β unsaturated acid is acrylic acid, methacrylic
 3 acid or mixtures thereof.
- 16. The method of claim 1 wherein, in (A), said 2 internal anhydride of an ethylenically unsaturated acid is 3 maleic anhydride.

- 1 17. The method of claim 1 wherein, in (B), said
- 2 alpha-monoolefin is ethylene.
- 1 18. The method of claim 1 wherein said carrier and
- 2 said polymer may be the same or different.
- 1 19. The method of claim 1 wherein said fiber-
- 2 forming polyamide is PA-6.
- 1 20. The method of claim 1 wherein said fiber-
- 2 forming polyamide is PA-66.
- 1 21. The method of claim 1 wherein said fiber-
- forming polyamide is PA-MXD6.
- 1 22. The method of claim 1 wherein said fiber-
- forming polyamide is PA-11.
- 1 23. The method of claim 1 wherein said fiber-
- 2 forming polyamide is PA-12.
- 1 24. The method of claim 1 wherein said fiber-
- forming polyamide is PA-69.

- 1 25. The method of claim 1 wherein said fiber-2 forming polyamide is PA-610.
- 1 26. The method of claim 1 wherein said fiber-2 forming polyamide is PA-612.
- 1 27. The method of claim 1 wherein said fiber-2 forming polyamide is an amorphous polyamide.
- 28. The method of claim 27 wherein said fiberforming amorphous polyamide is a copolymer of terephthalic acid and trimethylhexamethylene diamine.
- 1 29. The method of claim 1 wherein said combination 2 additionally contains a fiber-forming adjuvant.
- 1 30. The method of claim 29 wherein said fiber2 forming adjuvant is an anti-oxidant, stabilizer, colorant,
 3 processing aid, catalyst, filler, nucleating agent, anti4 microbial, melt viscosity enhancer or mixtures thereof.
 - 31. An acid dye stain-resistant fiber-forming polyamide composition comprising a combination of a masterbatch
 concentrate, a fiber-forming polyamide and a polymer, said

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masterbatch concentrate comprising a reagent and a carrier therefor wherein said reagent has the formula:

- wherein: Q and Z are moieties which associate with free acid dye sites in said polyamide;
- 9 a is an integer from 0 to 2;
- b is an integer from 1 to 4; and
- R is selected from the group consisting of aliphatic,
- aromatic or alicyclic hydrocarbyl groups; and
- 13 said carrier is selected from the group consisting of:
- (A) a terpolymer comprising from about 56% to about 94.5% by weight of at least one alpha-monoolefin having 2 to 8 carbon atoms, about 5% to about 40% by weight of an ethylene-α,β unsaturated carboxylic acid (1) C₁-C₄ alkyl or (2) glycidyl ester and from about 0.5% to about 4.0% by weight of an internal anhydride of an ethylenically unsaturated carboxylic acid;
- 21 (B) a semi-crystalline thermoplastic polyester 22 having a melting point of about 235°C or less;
- 23 (C) a semi-crystalline thermoplastic polyamide with 24 a melting point of about 235°C or less; and
- 25 (D) mixtures thereof;
 26 and further wherein said polymer is selected from the group
 27 consisting of (A) and mixtures of (A) with at least one of (B)

- and (C) wherein the percentage by weight in said polymer of internal anhydride of an ethylenically unsaturated carboxylic acid is in the range of from about 0.5% to about 4.0%.
 - 32. The composition of claim 31 wherein said masterbatch concentrate comprises from about 20% to about 80% by weight of said reagent.

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- 33. The composition of claim 31 wherein said combination contains an amount of said masterbatch concentrate that contains between about 1,500 ppm and about 3,000 ppm of sulfur; an amount of said polymer such that the combination contains between about 0.01% to about 0.6% of the internal anhydride; and the remainder is said polyamide.
- 1 34. The composition of claim 33 wherein at least 2 one of said Q and Z is a carboxylic acid group or a salt 3 thereof.
- 35. The composition of claim 33 wherein at least
 one of said Q and Z is an isocyanate group.
- 1 36. The composition of claim 33 wherein at least
 2 two of said Q and Z combine to form a carboxylic acid anhy3 dride.

- 1 37. The composition of claim 33 wherein said 2 reagent is 5-sulfoisophthalic acid or a salt thereof.
- 1 38. The composition of claim 37 wherein said 2 reagent is an alkali metal, alkaline earth metal or transition 3 metal salt of 5-sulfoisophthalic acid.
- 1 39. The composition of claim 38 wherein said reagent is the lithium salt of 5-sulfoisophthalic acid.
- 1 40. The composition of claim 38 wherein said 2 reagent is the sodium salt of 5-sulfoisophthalic acid.
- 1 41. The composition of claim 38 wherein said 2 reagent is 3-sulfobenzoic acid or the sodium or lithium salt 3 thereof.
- 1 42. The composition of claim 31 wherein, in (A), 2 said alpha-monoolefin is ethylene.
- 1 43. The composition of claim 31 wherein, in (A), 2 said ethylene- α , β unsaturated acid is acrylic acid, meth-3 acrylic acid or mixtures thereof.

- 1 44. The composition of claim 31 wherein, in (A), 2 said internal anhydride of an ethylenically unsaturated acid
- 3 is maleic anhydride.
- 1 45. The composition of claim 31 wherein, in (B),
- said alpha-monoolefin is ethylene.
- 1 46. The composition of claim 31 wherein said
- carrier and said polymer may be the same or different.
- 1 47. The composition of claim 31 wherein said fiber-2 forming polyamide is PA-6.
- 1 48. The composition of claim 31 wherein said fiber-2 forming polyamide is PA-66.
- 1 49. The composition of claim 31 wherein said fiber-2 forming polyamide is PA-MXD6.
- 1 50. The composition of claim 31 wherein said fiber-2 forming polyamide is PA-11.
- 1 51. The composition of claim 31 wherein said fiber-2 forming polyamide is PA-12.

- 1 52. The composition of claim 31 wherein said fiber-2 forming polyamide is PA-69.
- 1 53. The method of claim 31 wherein said fiber-2 forming polyamide is PA-610.
- 1 54. The method of claim 31 wherein said fiber-2 forming polyamide is PA-612.
- The composition of claim 31 wherein said fiberforming polyamide is an amorphous polyamide.
- 1 56. The composition of claim 55 wherein said fiber-2 forming amorphous polyamide is a copolymer of terephthalic 3 acid and trimethylhexamethylene diamine.
- The composition of claim 31 wherein said combination additionally contains a fiber-forming adjuvant.
- 1 58. The composition of claim 57 wherein said fiber2 forming adjuvant is an anti-oxidant, stabilizer, colorant,
 3 processing aid, catalyst, filler, nucleating agent, anti4 microbial, melt viscosity enhancer or mixtures thereof.

59. A masterbatch concentrate for addition to a fiber-forming polyamide to form an acid dye stain-resistant 2 fiber-forming polyamide, said concentrate comprising a reagent 3 4 and a carrier therefor wherein said reagent has the formula: (SO₃)_b | (Q)_a-R-Z 5 6 wherein: Q and Z are moieties which associate with free acid 7 dye sites in said polyamide; 8 a is an integer from 0 to 2; 9 b is an integer from 1 to 4; and 10 R is selected from the group consisting of aliphatic, 11 aromatic or alicyclic hydrocarbyl groups; and said carrier is selected from the group consisting of: 12 13 (A) a terpolymer comprising from about 56% to about 14 94.5% by weight of at least one alpha-monoolefin having 2 to 15 8 carbon atoms, about 5% to about 40% by weight of an ethylene- α , β unsaturated carboxylic acid (1) C_1 - C_2 alkyl or 16 17 (2) glycidyl ester and from about 0.5% to about 4.0% by weight 18 of an internal anhydride of an ethylenically unsaturated 19 carboxylic acid; 20 (B) semi-crystalline thermoplastic polyester 21 having a melting point of about 235°C or less; 22 (C) a semi-crystalline thermoplastic polyamide with 23 a melting point of about 235°C or less; and

mixtures thereof.

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(D)

- 1 60. The concentrate of claim 59 wherein said 2 masterbatch concentrate comprises from about 20% to about 80% 3 by weight of said reagent.
- 1 61. The concentrate of claim 60 wherein at least
 2 one of said Q and Z is a carboxylic acid group or a salt
 3 thereof.
- 1 62. The concentrate of claim 60 wherein at least 2 one of said Q and Z is an isocyanate group.
- 1 63. The concentrate of claim 60 wherein at least two of said Q and Z combine to form a carboxylic acid anhydride.
- 1 64. The concentrate of claim 60 wherein said 2 reagent is 5-sulfoisophthalic acid or a salt thereof.
- 1 65. The concentrate of claim 64 wherein said 2 reagent is an alkali metal, alkaline earth metal or transition 3 metal salt of 5-sulfoisophthalic acid.
- 1 66. The concentrate of claim 65 wherein said 2 reagent is the lithium salt of 5-sulfoisophthalic acid.

2 reagent is the sodium salt of 5-sulfoisophthalic acid.

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1 68. The concentrate of claim 65 wherein said 2 reagent is 3-sulfobenzoic acid or the sodium or lithium salt 3 thereof.

1 69. The concentrate of claim 59 wherein, in (A), 2 said alpha-monoolefin is ethylene.

- 70. The concentrate of claim 59 wherein, in (A), said ethylene- α , β unsaturated acid is acrylic acid, methacrylic acid or mixtures thereof.
- The concentrate of claim 59 wherein, in (A), said internal anhydride of an ethylenically unsaturated acid is maleic anhydride.
 - 72. The concentrate of claim 59 wherein, in (B), said alpha-monoolefin is ethylene.
- 1 73. An acid dye stain-resistant fiber or fibers 2 formed from the composition of claim 31.

- 74. An article of manufacture prepared with the fiber or fibers of claim 73.
 - 75. A textile article according to claim 74.
 - 1 76. A carpet according to claim 75.